Health Consultation

Response to Community Questions about Groundwater

LAYTONVILLE LANDFILL SITE
(a/k/a LAYTONVILLE DUMP)

LAYTONVILLE, MENDOCINO COUNTY, CALIFORNIA

EPA FACILITY ID: CAD000065532

APRIL 11, 2001

U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES
Public Health Service
Agency for Toxic Substances and Disease Registry
Division of Health Assessment and Consultation
Atlanta, Georgia 30333

Health Consultation: A Note of Explanation

An ATSDR health consultation is a verbal or written response from ATSDR to a specific request for information about health risks related to a specific site, a chemical release, or the presence of hazardous material. In order to prevent or mitigate exposures, a consultation may lead to specific actions, such as restricting use of or replacing water supplies; intensifying environmental sampling; restricting site access; or removing the contaminated material.

In addition, consultations may recommend additional public health actions, such as conducting health surveillance activities to evaluate exposure or trends in adverse health outcomes; conducting biological indicators of exposure studies to assess exposure; and providing health education for health care providers and community members. This concludes the health consultation process for this site, unless additional information is obtained by ATSDR which, in the Agency's opinion, indicates a need to revise or append the conclusions previously issued.

You May Contact ATSDR TOLL FREE at
1-888-42ATSDR
or
Visit our Home Page at: http://atsdr1.atsdr.cdc.gov:8080/

HEALTH CONSULTATION

Response to Community Questions about Groundwater

LAYTONVILLE LANDFILL SITE
(a/k/a LAYTONVILLE DUMP)

LAYTONVILLE, MENDOCINO COUNTY, CALIFORNIA

EPA FACILITY ID: CAD000065532

Prepared by:

Program Evaluation, Records, and Information Services Branch
Division of Health Assessment and Consultation
Agency for Toxic Substances and Disease Registry

Background and Statement of Issues

The California Department of Health Services (CDHS) Environmental Health Investigations Branch requested Agency for Toxic Substances and Disease Registry (ATSDR) assistance in responding to community questions concerning possible contamination of domestic water supply wells near the Laytonville Landfill in Mendocino County, California. The Laytonville Landfill is a now-closed municipal waste landfill. It is regulated under Subtitle D of the Resource Conservation and Recovery Act, and California solid waste laws and regulations. Covering approximately 37 acres, the Laytonville Landfill site is on Branscomb Road, some 1.7 miles southwest of downtown Laytonville. Sanitary waste disposal was confined to an approximately 4.7 acre area within the site boundaries.

During the late 1960s and early 1970s the site operated as a "burn dump." Beginning in 1974, residential waste, commercial waste, and construction debris were land filled. Following a 1993 decision to close the landfill, a closure plan was created and in 1997 the landfill was capped.

In 1987, three groundwater monitoring wells were installed on site (MW87-1, MW87-2, and MW87-3). Additional monitoring wells were installed in the 1990s. The 1987 monitoring wells were abandoned during installation of new monitoring wells MW93-1 and MW93-2. The current groundwater monitoring system comprises five monitoring wells installed between 1990 and 1994 (MW90-1, MW91-1, MW93-1, MW93-2, MW94-1).

In 1991, regular water analyses of landfill leachate emissions began. Chemical parameters for the analyses included metals and other inorganic compounds, volatile organic compounds (VOCs), and pesticides.

In 1986, Mendocino County Solid Waste Division (MCSWD) and the Regional Water Quality Control Board (RWQCB) received complaint letters from several nearby residents which included reports of "bright yellow" water flowing from the landfill.

The California Department of Health Services (CDHS), Environmental Health Investigations Branch, is currently preparing a public health assessment of the Laytonville Landfill under a cooperative agreement with ATSDR. In the course of investigating community health concerns, CDHS scientists learned of concerns regarding the possible contamination of local domestic drinking water wells. The concerns are summarized in the text box below:

Community Groundwater Concerns

1A. Are existing monitoring wells properly located to detect groundwater contamination?
1B. If the answer to 1A is no, how many more wells are needed, and where?
1C. Could gross contamination remain substantially undetected by current monitoring wells?
1D. Are the monitoring wells at the correct depth to detect contamination?
1E. If the answer to 1D is no, are deeper monitoring wells needed?

2A. Is there an existing true upgradient monitoring well?
2B. If the answer to 2A is no, where would an upgradient monitoring well be placed?

3. Should a monitoring well be installed south of the dumpsite, but within the landfill property?

4A. Is the Rancheria downgradient?
4B. Are Rancheria residents in danger of their groundwater becoming contaminated?

5. Are contaminated groundwater or surface water runoff likely to enter Cahto Creek?

6. Are the private wells near Cahto Creek likely to become contaminated?

7. Could any groundwater contamination flow into the bedrock aquifer, then off site?

8A. How many aquifers are under the landfill site?
8B. Are the aquifers confined, semi-confined or unconfined?

9A. Does the groundwater under the dumpsite follow the ground surface, in the shape of an inverted "U," or does it only remain at the level of the base of the hill?
9B. If the groundwater follows an inverted "U," is there a possibility of any seepage from the sides of that inverted "U"?

10. In winter and spring, how close is the groundwater flow to the underside of the dumpsite?

11. In the initial water tests, mineralization and high total dissolved solids, and high specific conductance were detected. Do those test results shed any light on the groundwater contamination question?

Discussion

Community questions focus on whether existing monitoring wells are effective in determining the existence of groundwater contamination on the landfill site, and, if so, whether any detected contamination threatens off-site drinking water wells.
To answer those questions, the CDHS scientists obtained and forwarded to ATSDR excerpts from site-specific groundwater investigations conducted by consultants on behalf of the Mendocino County Solid Waste Division (references 1-4). CDHS scientists also forwarded excerpts from reports prepared by environmental consultants for the Bureau of Indian Affairs (5) and U. S. Army Corps of Engineers' groundwater investigation and monitoring reports on the Laytonville Rancheria property east of the landfill (6). This technical information—including the drilling logs—was reviewed during preparation of this health consultation.

This health consultation supports the public health assessment process by addressing questions regarding possible groundwater contamination at the landfill. The responses to these questions are for public health purposes. They are not intended to be used for regulatory purposes, nor as a peer review of environmental investigations at the site. The quality of the responses is limited by the quality and quantity of the technical information reviewed. The information used in preparing this health consultation does not include a site visit by its principal author, nor interviews with any California-licensed hydrogeologists who might have conducted site specific investigations.

Responses are in italics, immediately below the questions.

1A. Are the monitoring wells properly located to detect groundwater contamination?
Past and current monitoring wells installed on site probably would have detected contamination if a large and continuous volume of highly contaminated groundwater flowed from the landfill. However, the complex hydrogeology of the site reduces the capability of a few monitoring wells to detect low volume, low concentration, groundwater contamination.

1B. If the answer of 1A is no, how many more wells are needed, and where?
For public health purposes, two additional monitoring wells are probably needed to provide an early warning if groundwater contamination exists and is moving toward residential wells immediately north of the property boundaries. The monitoring wells should be screened at the same depth as the residential wells. One monitoring well located in the northwestern corner of the property and another near the center of the northern boundary could provide some indication if groundwater contamination is occurring at levels of concern, and whether that contamination could reach residential wells.

1C. Could gross contamination remain substantially undetected by current monitoring wells?
Gross groundwater contamination (gross contamination is defined as a large and continuous volume of highly contaminated groundwater) is unlikely to be undetected. As indicated in the answer to 1A, past and current monitoring wells would probably have detected any large and continuous volume of highly contaminated groundwater.

1D. Are the monitoring wells at the correct depth to detect contamination?
For public health purposes, groundwater monitoring wells should serve as sentinels, guarding against contamination moving toward nearby drinking water supplies. To provide an early warning of drinking water well contamination, monitoring wells should monitor the aquifer and the depths from which the nearest drinking water well draws water. One of the earliest monitoring wells, MW 87-3 (now abandoned), appears to have been designed to monitor the same aquifer and depths as residential wells adjacent to the landfill's northern boundary. Monitoring Well 87-2 (also now abandoned) appears to have been designed to monitor groundwater in the bedrock aquifer near the landfill's eastern boundary, adjacent to the Rancheria property. Current monitoring well MW91-1 is, apparently, also designed to monitor the same aquifer and depths that supply water to drinking water wells located east of the landfill.

The remaining current monitoring wells appear to be designed to intercept contaminants in the uppermost aquifer on the east, north, and west sites of the capped disposal area. Because of the complexity of the site hydrogeology, no single well depth would be adequate to monitor all possible pathways of groundwater contamination. The different depths of the current monitoring wells appear to be a reasonable attempt to intercept likely groundwater contamination pathways. As indicated in response to question 1B above, two additional monitoring wells located closer to the northern boundary might provide additional warning if groundwater contaminants are present in that area and moving toward off-site drinking water wells. If installed, the two monitoring wells should monitor the aquifer utilized by the nearest drinking water wells, and should be at the same depths as those wells.

1E. If the answer to 1D is no, are deeper monitoring wells needed?

Not necessarily. Two additional monitoring wells near the northern boundary should be considered to monitor the same aquifer and depths of the nearby drinking water wells. Information from current and past bedrock monitoring wells indicates the fracture aquifer has an upward groundwater gradient; thus downward movement of groundwater contaminants from the landfill into a deeper groundwater zone seems unlikely. Consequently, it is doubtful that installing wells to monitor zones deeper than the abandoned 1987 monitoring wells would provide any new information or an improved monitoring system.

2A. Is there an existing true upgradient monitoring well?

No monitoring well upgradient of the landfill waste disposal area could be discerned from the information reviewed.

2B. If the answer to 2A is no, where would an upgradient monitoring well be placed?

For public health purposes, an upgradient well is not needed. A residential well in a similar geology but not downgradient from the site could, for public health purposes, provide general information about local water chemistry.

3. Should a monitoring well be installed south of the waste disposal site, but within the landfill property?

Not unless there is a drinking water spring or well adjacent to that southern boundary that requires protection by providing additional on-site monitoring.

4A. Is the Rancheria downgradient?

A portion of the groundwater flowing from the landfill could flow beneath the Rancheria property. Monitoring wells MW93-2 and MW91-1 probably intercept some of the groundwater moving from the capped disposal area toward the Rancheria property. The complexity of the hydrogeology limits complete characterization of the volume and chemistry of the groundwater flow toward the Rancheria property. However, available groundwater monitoring does not indicate a major contaminant plume.

4B. Are the Ranchiera residents in danger of their groundwater becoming contaminated?
In 1996, monitoring by the U.S. Army Corps of Engineers (COE) did not detect landfill groundwater contaminants present in Rancheria groundwater. However, the monitoring of Rancheria groundwater is limited. For example, the technical information reviewed indicates that past and existing drinking water wells in Rancheria have not been monitored for any specific contamination from the landfill.

5. Are contaminated groundwater or surface water runoff likely to enter Cahto Creek?
Based on the technical information provided, Cahto Creek is unlikely to receive enough contaminated groundwater from the landfill to be discernible from other contaminants flowing from upstream sources, (i.e., mining operations). A portion of the surface runoff from the landfill property probably does drain into Cahto Creek.

A review of topographic maps and aerial photographs indicates surface water runoff from the southwestern side of the landfill could flow into a minor tributary of Cahto Creek. Also, the southeastern side of the landfill appears to drain toward Cahto Creek. However, the northern portion of the landfill property probably drains toward Cahto Lake north of Branscome Road rather than into Cahto Creek. Review of the technical information provided did not indicate the presence of high levels of surface water contaminants flowing from the landfill into Cahto Creek.

Although some groundwater flowing from the landfill property probably reaches Cahto Creek, the marshy area on the northeastern side of the landfill property and Cahto Lake to the northeast are also likely receiving areas for groundwater flowing from the landfill site.

6. Are the private wells near Cahto Creek likely to become contaminated?
The COE report did not identify any site-specific chemical contaminant moving from the landfill to the uppermost groundwater zone on the Cahto Reservation. Past and current on-site groundwater monitoring does not indicate sufficient concentrations or volume of groundwater contaminants to pose a problem for most off-site residential wells. However, the information is too limited to predict continued safety of nearby domestic drinking water wells. For example, a domestic well is reported in use immediately north of the central border of the landfill property. No analysis of that well water has been provided to determine if the well has been contaminated by landfill sources.

7. Could any groundwater contamination flow into the bedrock aquifer, then off site?
The reviewed technical information does not provide enough information on the vertical groundwater gradient to or from the bedrock aquifer to completely answer this question. As previously discussed, there is probably some downward leakage of groundwater into the bedrock aquifer in the general area. However, contaminants and levels reported from the past and current groundwater monitoring wells do not indicate any significant levels of contaminants in the deeper groundwater.

Also, information from some of the monitoring wells screened in fractured material (assumed bedrock aquifer) indicate the vertical flow gradient maybe upward, not downward, at the monitoring well location. If the bedrock groundwater is under higher pressure than the overlying groundwater, vertical movement of landfill contaminants into a zone of higher pressure seems unlikely.

8A. How many aquifers are under the landfill site?
The best estimate would be at least 3 groundwater zones; one perched zone, a water table aquifer in unconsolidated material such as alluvium, and a confined or semi-confined bedrock aquifer. However, the multiple clay lenses and clayey layers could create multiple isolated perched zones of water in thin layers.

8B. Are the aquifers confined, semi-confined or unconfined?
The perched zones are unconfined, as is the water table aquifer. The bedrock aquifer probably varies from semi-confined to confined, depending on overlying materials and hydraulic connection to alluvium.

9A. Does the groundwater under the dumpsite follow the ground surface in the shape of an inverted "U," or does it only remain at the level of the base of the hill?
Flow patterns in the upper groundwater zones are influence the topography. However, the multiple zones of mixed clays, sands, and gravels are too complex to produce a simplistic flow pattern such as an inverted "U" or a water table level with the base of the hill. To produce a simple "U" shape flow pattern, the geologic materials would need to uniformly porous and permeable, such as only sandy materials, beneath the landfill site. As indicated above, drilling logs and monitoring wells indicated some perched zones; that is, thin layers of water separated from the water table (zone of water-saturated geologic materials) by clay lenses and unsaturated geologic materials.

These thin layers of water do not constitute a true aquifer capable of providing an adequate well water supply. If contaminants are moving downward into soil and rock beneath the landfill, the contaminants will first flow into, then laterally along, the thin layers of water until a vertical pathway is available for further downward movement. If an effective leachate drainage system is not operating at the landfill, some of the contaminated water will emerge from the sides of the landfill as leachate or contaminated seeps and springs, flowing downhill along surface drainage pathways.

Consequently, the flow pattern from the closed disposal area is not so much an inverted "U" as it is a leaky series of clayey steps with both lateral and vertical flow components. Some vertical components will enter the fractured rocks of the Franciscan formation at elevations higher than the elevations at the northern dumpsite boundary. Water in those fractures will be confined by the clayey layers and rock above.

9B. If the groundwater follows an inverted "U," is there any seepage from the sides of that inverted "U"?
See response to 9A, above.

10. In winter and spring, how close is the groundwater flow to the underside of the dumpsite?
The technical information reviewed is insufficient to address adequately this question.

11. In the initial water tests, mineralization and high total dissolved solids, and high specific conductance were detected. Do those results shed any light on the groundwater contamination question?
Groundwater may be naturally high in minerals and dissolved solids, resulting in high conductance readings. The only way to determine if the high levels of specific conductance indicate a public health problem is to measure for specific metals and other contaminants and compare those results with other, uncontaminated local groundwater sources. By themselves, reports of high total dissolved solids do not provide any meaningful information for public health analysis of drinking water.

ATSDR's Child Health Initiative

The Child Health Initiative recognizes that the unique vulnerabilities of infants and children demand special emphasis in communities faced with contamination of environmental media. As part of this initiative, ATSDR health consultations must indicate whether any site-related exposures are of particular concern for children. At this site, sampling has identified contaminants in the monitoring wells on site. However, no information was provided on nearby drinking water wells. Therefore, from the data reviewed, ATSDR does not have information that allows scientist to specifically identify children who use might use contaminated groundwater. The recommendations forwarded in this document are intended to protect children, as well as, adults.

Conclusions

Public health conclusions about groundwater contamination at the Laytonville Landfill are limited by the complexity of the site hydrogeology and available technical information. Sampling and analytical results from past and current monitoring wells do not indicate the presence of a large volume of highly contaminated groundwater on the site. Existing municipal water supply wells in Laytonville are unlikely to be affected by any groundwater contamination from the Laytonville Landfill because of the distance and direction the contaminants would have to travel to affect the municipal wells. While the groundwater monitoring by the COE does not indicate the abandoned water supply wells on the Rancheria property are likely to be affected by possible groundwater contaminants from the landfill, the water from the Rancheria wells has not been analyzed to confirm past or future safety. Groundwater monitoring information is too limited to determine if residential, drinking water wells immediately north of the landfill are threatened by groundwater contaminants from the landfill.

Recommendations

1. Install of two additional monitoring wells on the northwestern and north-central boundaries of the landfill property to determine if any significant groundwater contamination exists in those areas, and, if so, to determine whether the contaminants could move toward nearby drinking water wells. The monitoring wells should be designed to monitor the same groundwater zones as the nearest drinking water wells still in use.

2. Perform sampling and analysis of all drinking water wells still in use near the northeastern and north-central landfill boundaries.

3. Perform sampling and analysis of any water supply well on Rancheria property before re-instituting use for drinking water supply.

Prepared by

John H. Mann
Environmental Health Scientist
Program Evaluation, Records, and Information Services Branch
Division of Health Assessment and Consultation

Reviewed by

Susan Moore, Chief
Consultation Section
Exposure Investigation and Consultation Branch
Division of Health Assessment and Consultation

Larry Cseh, MSA
Chief, Program Enhancement Section
Program Evaluation, Records, and Information Services Branch
Division of Health Assessment and Consultation

Max M. Howie, Jr., M.S.
Chief, Program Evaluation, Records, and Information Services Branch
Division of Health Assessment and Consultation

References

1. EBA Wastechnologies. Table 1. In: Water quality SWAT report for Laytonville solid waste disposal site, County of Mendocino. April 1990.

2. SHN Consulting Engineers & Geologists. Log of monitoring well 91-1 from report of waste discharge, Laytonville solid waste disposal site. Eureka, CA. November 1991.

3. Anderson Consulting Group. Excerpts from geologic and hydrogeologic report, Laytonville sanitary landfill. Roseville, CA. March 1995. p. 9-10, boring logs, appendix B, figures 2-3, tables 4-5.

4. Anderson Consulting Group. Excerpts from report to Mendocino County Solid Waste Division. File No. 3200-77.606. Roseville, CA. December 1996. p. 3-5.

5. Ott Water Engineers, Inc. Excerpts from multi-purpose water resources investigation, Laytonville Rancheria for Tribal Council and Bureau of Indian Affairs. February 28, 1979. p. 12-18.

6. U.S. Army Corps of Engineers. Quarterly sampling and analytical reports, Laytonville Rancheria. Sacramento, CA. Department of the Army. 1998.